Warnings were issued whenever possible for these floods and also for the rises in the Red, the James, and the rivers of North Carolina and South Carolina. The following report on the Pecos River flood was prepared by Mr. F. H. Brandenburg, Official in Charge, U. S. Weather Bureau office, Denver, Colo.:

After the 21st heavy local downpours occurred in the Capitan, Sacramento, and Guadalupe mountains. Coincident with the coming of the flood waters from the mountains, heavy rains set in over the lower altitudes to the eastward. Only moderate stages prevailed in the Pecos above Roswell, N. Mex., but below that point the river rose rapidly, as each tributary was at flood stage. The Penasco and Felix washed out a county bridge and some railroad bridges. The Hondo, which empties into the Pecos near Roswell, was reported to be very high, but there was no serious damage owing to the protection afforded by the new dikes. On the 26th the stage of the Pecos at Carlsbad was 14.2 feet, and on the morning of the 28th, near Pecos, Tex., the gage showed 18.3 feet, or a rise of ten feet in 48 hours. After remaining practically stationary for 24 hours the river fell rapidly, falling below the danger line on August 1.

Interests at Roswell were advised on the morning of the 23d that a sharp rise in the Hondo was expected, and the general manager of the Barstow Irrigation Company, at Barstow, Tex., was informed of the heavy rainfall in the mountain districts. On this date there was a scarcity of water for irrigation, the gage reading at the flume at Barstow being only one foot. On the morning of the 25th all points between Carlsbad and Barstow were advised of approaching flood stages. To Pecos and Barstow the following warning was sent: "High water by Thursday night, 27th; river will continue rising." While for other points up stream the time set was correspondingly earlier. These timely warnings were fully appreciated, and resulted in the saving of much property.

The flood in the White River of Arkansas began on the 29th after two days of excessive rainfall over the watershed, and by the close of the month danger-line stages were general, with the river still rising. Warnings were first issued on the 28th. A report of this flood will appear at a later date.

The highest and lowest water, mean stage, and monthly range at 279 river stations are given in Table VI. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Professor of Meteorology.*

CLIMATE AND CROP SERVICE.

By Mr. JAMES BERRY, Chief of Climate and Crop Divison.

The following summaries relating to the general weather and crop conditions during July are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau; they are based upon reports from cooperative observers and crop correspondents, of whom there are about 3300 and 14,000, respectively:

Alabama.—Rainfall heavy to locally excessive in some northern, middle, and southwestern counties, insufficient elsewhere. Cotton made fairly good growth and fruited moderately well until latter part of month, when crop was deteriorating over half the State, with rust spreading and shedding becoming general; grown bolls numerous by 20th, some opening during last few days. Corn and minor crops advanced fairly well; early corn maturing and late corn earing well last decade, when considerable fodder was pulled.—*F. P. Chaffee.*

Arizona.—Frequent, though light, local rains and thunderstorms last half of month revived vegetation generally and afforded a plentiful water supply for irrigation and stock. Wheat, barley, and oat harvest completed in south and central portions 15th. Second and third alfalfa cuttings not finished in northern and central sections; fourth crop blooming in southern. Light frost 15th and hail 19th and 26th damaged gardens and fruit. Large grape shipments. Stock thrifty. Late corn crop making good growth.—*L. N. Jesunofsky.*

Arkansas.—Unusually cool and wet. Farm work greatly retarded. Cotton made slow growth, was small, did not fruit well, and was injured by insects locally; some fields were abandoned on account of weeds. Early corn was laid by; late suffered from lack of cultivation and too much moisture. Wheat and oat harvest progressed slowly; some grain injured in shock by moisture. Apples and peaches deteriorated.—*O. C. Burrows.*

California.—Clear, seasonable weather prevailed in the interior and cool, foggy weather in the coast sections most of the month. The temperature was abnormally high in nearly all sections on the 7th and 8th, and in many places previous records were broken. Grapes, berries, and deciduous fruits were considerably injured by the heat. The hay crop was nearly all gathered and was the best for several years. Grain harvesting was nearing completion.—*Alexander G. McAdie.*

Colorado.—The prevailing droughty conditions in the southern and western parts of the State were effectively broken by showers toward the close of the month. During the last decade the harvesting of winter wheat, rye, and barley was progressing satisfactorily, as also that of spring wheat in Weld County, and the second crop of alfalfa in the Arkansas Valley; oats were ripening, and corn, beets, and potatoes were making good growth.—*F. H. Brandenburg.*

Florida.—The month gave normal temperature and practically the average amount of precipitation. The cotton crop did very well during the first part of the month, except over the western portion, where the weather was too dry. As the month advanced rain came more regularly and was frequently locally heavy, doing damage to cotton in central and northern districts. Late corn was improved, and a large acreage was set to sweet potatoes. Cane, citrus trees, pineapples, and minor crops did well.—*A. J. Mitchell.*

Georgia.—Temperature was about normal; rainfall irregular, most too wet the first and second decades, too dry the third. Cotton grew rapidly, made too much weed at expense of forms, needed rain at end of month, some fields grassy, injury by black root, lice, rust, and shedding; began to open south 25th. Early corn variable; late varieties injured by rain first and by drought last of month. Fodder and hay being saved last decade. Peach and melon shipping about completed, latter good crop, former below average. Minor crops generally good. Large crop of peas.—*J. B. Marbury.*

Hawaii.—Weather warm and sultry during entire month, with rainfall considerably above the normal in many sections. Some damage occasioned to growing cane at intervals by high winds, but conditions otherwise generally favorable for rapid progress. Grinding of 1905 cane nearly finished, with a satisfactory yield; planting for 1907 crop continues. An exceptionally fine summer crop of pineapples being harvested; plants in excellent condition. Second crop of rice being planted. Coffee picking begun. Leeward pastures, except in higher levels, short during most of month.

Idaho.—The first half of the month was generally rather cool; the latter half was excessively hot in western and northern counties, causing some damage to late oats and spring wheat. Fall sown and early spring wheat yielding well. Corn made good growth. The portion of the hay crop harvested was average or above, but in some localities late crops suffered owing to scarcity of water. Grass on lower ranges became very short and dry, but in most instances stock found ample subsistence in higher mountains.—*Edward L. Wells.*

Illinois.—The month opened cool, with temperatures decidedly below the seasonal average. In low places in parts of the northern district light frost formed, but no damage was reported. During the first decade the harvesting of oats was begun in the central and southern districts, and wheat was mostly in shock and some thrashing had been done. At the end of the month corn was earing out nicely, having maintained a fine condition throughout the month.—*Wm. G. Burns.*

Indiana.—Cutting of wheat practically finished before middle of July. During the latter part of month cutting oats, making hay, and thrashing wheat progressed rapidly and generally with satisfactory results as to output and quality of crops. Corn made good growth and was mostly laid by in good condition. Cucumbers, tomatoes, melons, and tobacco did well and field onions improved. A large crop of blackberries was gathered.—*W. T. Blythe.*

Iowa.—July was deficient in temperature and rainfall, but there was sufficient warmth and moisture to promote the normal growth of corn, potatoes, and vegetables, and ripen wheat, oats, barley, and rye. Some hindrance was caused by showery and cloudy weather the first half of month, but during the latter part conditions were generally favorable for hay and grain harvest, with good yield secured. Corn in good condition at close of month. Apple crop very light.—*John R. Sage.*

Kansas.—Wheat harvest was over by the 15th, except in a few extreme northern counties; thrashing and stacking progressed rapidly, showing a fair yield and good quality. Corn grew rapidly and continued in fine condition; it was tasseling, silking, and earing in northern counties at close of month. Oat harvest finished, with fair yield and good quality. Prairie haying and fall plowing begun. Apples and potatoes good. Cutting third crop alfalfa began the last week.—*T. B. Jennings.*

Kentucky.—Temperature above normal at opening of month and again from 15th to 17th, but averaged slightly deficient. Precipitation in excess of normal, except in extreme northern and several western counties. Wheat harvested and thrashed, with slight damage from wet weather; yields varying. Oats and rye thrashed and stacked in good condition, with some slight damage from moisture. Hay plentiful, but poor. Tobacco generally vigorous, but needing cultivation; mostly topped and some cutting commenced. Fruit falling badly.—*F. J. Walz.*

Louisiana.—Showery weather prevailed during the greater portion of

the month, which favored a rapid growth of vegetation, but materially interfered with the cultivation of crops. Cotton suffered seriously as a result of the inability of planters to kill grass and weeds. Many fields of cotton were abandoned during the month and generally the crop made very little progress, the condition being much below the average for this season of year. Sugar cane grew rapidly and as a rule the conditions were excellent. Rice was irregular; harvest and thrashing under way. Corn was in poor condition. Truck gardens made satisfactory growth.—*I. M. Cline.*

Maryland and Delaware.—July was unusually wet, with temperature about normal. Wheat saved in fair condition, and where properly dried results were satisfactory, but much early thrashed was damp. Good crop oats harvested. Corn fodder heavy and ears began to shoot. Much hay spoiled by rain, crop light. Pears and apples fair. Peaches scarce. Tobacco on light soil poor, on firm soil a short crop. Tomatoes fruited poorly and ripened too slowly. Early potatoes rotted badly.—*C. F. von Herrmann.*

Michigan.—Frequent showers during first half of month interfered with field work, especially in central and southern counties, but drier weather during latter half was very favorable to haying and harvest work. A large hay crop and a very good wheat yield were generally well secured during the latter half of month. Oats, corn, late potatoes, and sugar beets made good growth throughout the month. Oat harvest was well under way at close of month. Buckwheat seeding germinated well. Apples, on account of wet weather, became scabby and dropped badly. Peaches and pears continued in good condition.—*C. F. Schneider.*

Minnesota.—High temperatures from 14th to 19th gave corn splendid start. Considerable rain early and late in month. Meadows flooded and rivers very high early in month. Spring wheat, oats, barley, and flax heading on southern highlands early in month. Winter wheat and barley cutting began about 15th, and spring wheat cutting on 26th. Black rust infection widespread on 20th, but no injury resulted. Stacking barley and rye and thrashing from shock late in month.—*T. S. Outram.*

Mississippi.—Frequent and heavy rains hindered cultivation over much of the State. Upland cotton grew rapidly, but generally fruited poorly. Lowland cotton continued small and was only beginning to bloom at the close of the month. Many grassy fields were abandoned. Complaints of rust, blight, and shedding were serious in some northern and eastern counties. Old corn matured and fodder pulling was commenced. Young corn, peas, cane, potatoes, and meadows were generally in good condition. The fruit crop was poor.—*W. S. Belden.*

Missouri.—Weather during July was generally favorable, although excessive precipitation in southern counties caused more or less damage to grain in shock and to crops and property along the smaller streams subject to overflow. Corn made vigorous growth and at the close of the month was well advanced toward maturity. Grain thrashing made fair progress where not hindered by rains. Cotton made good growth. Considerable hay was damaged. Potatoes and all minor crops were looking well.—*George Reeder.*

Montana.—Favorable temperatures prevailed, being normal or above, except for one or two brief periods. Rainfall above normal and well distributed. Haying progressed favorably. Wheat, oats, rye, and barley made vigorous growth; winter wheat harvest began the last week. Range grass remained green and cattle and sheep were in excellent condition. Garden vegetables and small fruit abundant. Apple trees heavily loaded and fruit excellent.—*R. F. Young.*

Nebraska.—Winter wheat harvest was completed, with exceptionally favorable weather. Thrashing began and winter wheat proved to be an excellent yield of fine quality. Oat harvest progressed rapidly. An excellent crop of prairie hay was partly secured, but much remained to be cut. Corn was small early in the month, but made an excellent growth. It tasselled about ten days later than usual and was in excellent condition at the end of the month.—*G. A. Loveland.*

Nevada.—The month was remarkably dry, with two periods of unusually warm weather, from the 4th to 10th and 19th to 25th. Nearly cloudless skies prevailed the entire month. Haying and harvesting progressed without interruption. Vegetable crops did well in localities supplied with irrigation water. Range feed dried up rapidly, though stock continued in good condition. Insect pests damaged garden truck greatly in several places.—*J. H. Smith.*

New England.—The weather of the month was generally pleasant, with more than the usual number of clear days and without special features. The maximum temperatures, as a rule, occurred in the second decade and the closing days were cool. The precipitation was somewhat excessive in some northern sections and deficient over most of the southern portion of the district. The weather conditions were generally favorable for crop growth and for harvesting.—*J. W. Smith.*

New Jersey.—The month was noted for the very uneven distribution of rainfall, which came in the form of showers. Some portions of all sections received an excess and others a marked deficiency. Crops, especially potatoes and apples, were greatly shortened in the droughty portions. The harvesting of wheat, rye, hay, and oats was completed and the crops housed in fine condition. Thrashing was in progress.—*Edward W. McGann.*

New Mexico.—Previous to the 19th showers were insufficient, streams low, stock water scarce, and range grasses dry and browning. Stock, however, remained in good condition, and the heavy showers of last decade fully revived range grasses, field crops, gardens, alfalfa, and fruits, and renewed the water supply. Considerable flood damage occurred in southeastern districts. Reaping and thrashing of small grain and harvest of second crop alfalfa continued slowly throughout the month, good grain yields being generally secured. Fruits were abundant and excellent.—*Charles E. Linney.*

New York.—The month as a whole was favorable for crops and farm work. The temperature was generally above normal until the 20th and below after that date. Precipitation was fairly well distributed. Hay, wheat, and rye were mostly secured in good condition, and the cutting of barley begun. Oats and corn improved very much, and beans, hops, tobacco, and sugar beets made fairly satisfactory growth. Apples, pears, and plums deteriorated somewhat, but peaches and grapes did well.—*W. C. Devereaux.*

North Carolina.—The month of July was not so favorable as June for the growth of crops. The first decade of the month was very good, but after the 10th heavy rains continued for a week, flooded lowlands, and caused considerable damage. Cotton was growing satisfactorily in a great many places, but shedding and rust were frequently reported. Tobacco was injured slightly by excessive rains, but was generally doing well. Thrashing of grain was about over. Other crops doing nicely. Fruit poor.—*A. H. Thiessen.*

North Dakota.—The temperature was slightly lower than the average and the precipitation considerably in excess of the usual amount, making the month a very favorable one for farming operations. All crops made excellent progress, except flax and corn, it being too cold and wet for them. Red rust had made its appearance in most grain fields, and some black rust was also found, but no material damage was done by either.—*B. H. Bronson.*

Ohio.—Corn improved rapidly during the month, but was weedy and uneven; earliest tasseling and earing well. Wheat harvesting and thrashing continued, with yields varying from fair to good; some damage by rust and weevil reported in the north. Oat and rye cutting and thrashing were well advanced toward the end of the month; good yields reported. Potatoes fair. Some tobacco being topped. Apples, pears, and plums poor crops. Peaches and grapes fair to good.—*Harry O. Geren.*

Oklahoma and Indian Territories.—The month was cool and wet. Wheat and oats thrashed out poor to good yields. Fall wheat plowing well advanced. Early corn maturing and doing well. Cotton improved and squaring, fruiting, and bolling; some not fruited well, but generally in fair to good condition. Broom corn, cane, alfalfa, millet, potatoes, hay, and fruit giving fair to good yields. Range good and stock doing well.—*C. M. Strong.*

Oregon.—July was favorable for harvesting hay and grain. The bulk of the hay crop was secured during this month, and it turned out to be extra good, both in quantity and quality. The barley harvest began early and the cutting of wheat began by the 15th. Fall sown wheat and barley yields were above the average, but spring sown wheat and oats were disappointing. Corn did extra well. Early potatoes were plentiful in the markets.—*Edward A. Beals.*

Pennsylvania.—As a whole the weather during the month was favorable for farm work and the advance of growing crops and, at its close, a large acreage of hay and oats had been secured in good condition. Pastures were furnishing ample feed.—*T. F. Townsend.*

Porto Rico.—Weather generally favorable, except in the southwestern section, where a drought prevailed throughout the month. Cotton badly damaged by worms, especially in the southeast portion of the island. Coffee abundant; quality not yet determined. Cane grinding about completed in most sections. Young cane would have been generally benefited by more rain. Good rice crop gathered. Small fruits in general abundant and of good quality.—*A. L. Brockway.*

South Carolina.—There were two periods of excessive heat, but the ground was so well supplied with moisture that the conditions were tropical in the luxuriant growth of all vegetation. Cotton attained an unusual size, and in places fruited well, while in others not so well; on sandy lands deterioration set in during the last decade, due to rust and shedding. The month was altogether favorable for corn and minor crops.—*J. W. Bauer.*

South Dakota.—Crops materially damaged on some flooded lowlands early in the month, but generally spring wheat, oats, barley, rye, spelt, corn, flax, and potatoes made good progress. Grass was excellent and haying was favorably advanced. At the close of the month wheat harvest had begun south, but there was considerable complaint of smut and scattered fields showed a little, but not damaging, black rust; oat and spelt harvest was well under way; barley cutting was well advanced; early flax was bolling; and in the southern counties early corn was silking.—*S. W. Glenn.*

Tennessee.—The weather was very wet from the 1st to the 12th, seriously interrupting the cultivation of crops and saving of hay and grain, and damaging much grain. The fair weather of the 13th to 20th was followed by a showery spell lasting to the end of the month. Early corn was generally good, but late plantings were in bad condition at the end of the month. Cotton was overgrown and weedy. Tobacco was in very good condition. Wheat yielded a poor crop. Oats were fairly good. The

SUMMARY OF TEMPERATURE AND PRECIPITATION BY SECTIONS, JULY, 1905.

In the following table are given, for the various sections of the Climate and Crop Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings.

The mean temperatures for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperature and precipitation are based only on records from stations that have ten or more years of observation. Of course the number of such records is smaller than the total number of stations.

Section.	Temperature—in degrees Fahrenheit.							Precipitation—in inches and hundredths.					
	Section average.	Departure from the normal.	Monthly extremes.					Section average.	Departure from the normal.	Greatest monthly.		Least monthly.	
			Station.	Highest.	Date.	Station.	Lowest. Date.			Station.	Amount.	Station.	Amount.
Alabama	79.4	— 0.7	Thomasville	103	22	Riverton	55 26	4.56	—0.66	Mobile	9.18	Notasulga	1.08
						Camp Hill	55 27						
Arizona	79.2	— 1.5	Parker	127	7	Flagstaff (a)	36 2	1.02	—0.69	Alpine	3.95	4 stations	0.00
Arkansas	76.7	— 3.3	Lacrosse	106	14	Mountainhome	51 4	7.60	+3.66	Dodd City	22.35	Brinkley	1.84
California	74.8	— 0.5	Volcano Springs	128	5	Bodie	18 16	0.01	—0.04	Yreka	0.48	Many stations	0.00
Colorado	64.2	— 2.4	Las Animas	103	17	Wagon Wheel Gap	24 2	2.05	+0.09	Lake Moraine	6.65	Fruita	0.07
						Antelope Springs	24 5						
Florida	81.5	0.0	Orange City	102	4	DeFuniak Springs	61 16	7.55	+0.03	Inverness	19.67	Jasper	2.30
						Molino	61 12						
Georgia	80.3	+ 0.2	Hawkinsville	104	20	Dahlonega	54 26	4.57	—1.21	Clayton	13.13	Hawkinsville	0.66
Hawaii	†74.5	.....	Kihei, Maui	94	30	Humuula, Hawaii	35 2	†5.33	.....	Nahiku, Maui	25.59	Ewa, Oahu	0.08
Idaho	68.3	.....	Glenns Ferry	113	23	4 stations	30 3 dates	0.33	.....	Idaho Falls	1.12	4 stations	0.00
Illinois	73.2	— 2.6	Chester	99	16	Lanark	45 24	4.93	+0.89	Chester	13.56	La Salle	1.49
			Lagrange	99	17								
Indiana	73.9	— 1.7	Rome	100	17	Kokomo	45 25	4.59	+1.56	Mount Vernon	10.64	Kokomo	1.45
Iowa	70.6	— 3.8	Waukee	102	16	Washta	40 25	2.91	—1.44	Albia	7.08	Washta	0.69
Kansas	74.5	— 3.6	Medicine Lodge	108	18	Hoxie	34 3	5.55	—1.48	Fort Scott	11.45	Garden City	0.86
Kentucky	75.9	— 0.8	Paducah	102	16	Beaverdam, Burnside, Scott	52 26	5.93	+1.09	Alpha	10.48	Scott	1.40
Louisiana	80.2	— 1.6	Reserve	106	15	Amite	59 7	8.52	+2.47	Covington	14.57	New Orleans	3.93
						Mansfield	59 11						
Maryland and Delaware	75.3	— 0.6	Md. Ag'l College, Md. Milford, Del	101	18	Deer Park, Md	42 9,25	7.36	+2.80	Bachman's Valley, Md.	14.70	Newark, Del	2.86
Michigan	67.7	— 1.1	Jackson	97	17	Wetmore	24 21	4.31	+1.31	Traverse City	7.46	Humboldt	0.56
Minnesota	67.3	— 2.3	Wabasha	100	16	Angus	38 23	4.12	+0.59	Mount Iron	9.44	Caledonia	0.69
						Pine River Dam	38 25						
Mississippi	79.1	— 2.0	Magnolia	102	16	Magnolia	58 7	4.57	—0.77	Woodville	10.58	Holly Springs	1.50
Missouri	73.4	— 3.8	Princeton	101	16	Fulton, Louisiana	48 25	7.45	+3.21	Lockwood	17.98	Princeton	2.35
Montana	65.9	0.0	Hayden	101	21	Fort Logan	25 2	1.52	+0.16	Graham	3.38	Saltese	0.00
			Troy	101	22	Grayling	25 5						
Nebraska	70.4	— 3.7	Hooper, Leavitt	102	16	Agate	38 9	4.67	+1.16	Beaver City	13.90	Winnebago	1.20
Nevada	72.1	— 0.7	Sodaville	109	12	Potts	31 17	0.03	—0.53	Halleck	0.40	15 stations	0.00
			Martins Ranch	109	21								
New England*	69.9	+ 0.2	Norwalk, Conn	98	3 dates	Van Buren, Me	38 21	3.63	—0.68	Cornish, Me	9.11	Lowell, Mass	0.59
						Grafton, N. H	38 22						
						Layton	42 26						
New Jersey	74.4	— 0.4	Somerville	102	18	Charlotteburg	42 26, 27	4.06	— 0.95	Plainfield	8.19	Atlantic City	1.67
New Mexico	70.9	— 1.8	Carlsbad	109	12	Winsor's	30 1	2.65	—0.55	Elk	15.10	Albuquerque	0.22
New York	70.2	+ 1.0	3 stations	99	18	Indian Lake, North Lake.	35 22	5.08	+0.69	Moira	10.73	Coeymans	0.67
North Carolina	77.3	— 0.4	Pinehurst	105	3	Linville	46 26	7.90	+2.35	Linville	6.90	Henderson	3.89
North Dakota	65.6	— 2.7	Dickinson	100	11	Cando	32 8	3.90	+1.44	Minnewaukon	6.91	Buford	0.68
						Hannaford	32 17						
Ohio	73.0	— 0.8	Bladensburg	100	10	Canal Dover	44 1,2	3.93	+0.09	Colebrook	7.65	Cincinnati	1.04
Oklahoma and Indian Territories.	77.7	— 2.8	Chickasha, Ind. T.	107	30	Kenton, Okla	46 10	5.50	+2.32	Hartshorne, Ind. T.	11.60	Newkirk, Okla	1.64
Oregon	68.6	+ 3.4	Umatilla	115	21	Bend	30 14, 17	0.16	—0.31	Newport	0.86	21 stations	0.00
						Silver Lake	30 18						
Pennsylvania	72.6	+ 0.4	Hanover	99	18	Coudersport	39 27	4.87	+0.30	Greenville	9.78	Springmount	2.49
			Philadelphia (c)										
Porto Rico	78.9	.....	Manati	97	2	Adjuntas	53 22	6.12	.....	San Lorenzo	12.91	Isabela	1.63
South Carolina	80.4	+ 0.5	Bowman, Winnsboro	101	4	Darlington	60 21	6.16	+0.65	Calhoun Falls	14.29	Saint George	3.15
			Dillon	101	21	Walhalla	60 26						
South Dakota	68.5	— 3.5	Elk Point	101	16	Ramsay	38 9, 24	3.69	+1.28	Fort Meade	10.33	Brookings	0.98
Tennessee	76.4	— 1.0	Arlington, Pope	99	17	Silver Lake	49 26	4.32	—0.46	Silver Lake	10.09	Centerpoint	1.28
Texas	80.6	— 2.0	Comanche	112	30	Texline	45 10	4.06	+1.20	Bonham	13.91	Rockport	0.00
Utah	71.5	— 0.1	Thistle	112	11	Thistle	26 4	0.52	—0.07	Ranch	2.28	6 stations	0.00
Virginia	75.4	— 0.6	Cape Henry	98	18	Blacksburg	34 29	7.18	+2.64	Buchanan	13.13	Petersburg	3.19
Washington	67.6	+ 1.2	Mottinger's Ranch	114	21	Cusick	33 8, 14	0.35	—0.31	Sedro-Wooley, Snohomish.	1.54	6 stations	0.00
West Virginia	73.3	— 0.7	Moorefield, Romney	98	17	Bayard	43 26	5.92	—2.17	Burlington	10.64	Nuttallburg	3.00
Wisconsin	68.1	— 2.1	Darlington	100	16, 18	Grand Rapids	35 26	3.67	—0.31	Sturgeon Bay	8.90	Prairie du Chien	1.45
Wyoming	61.6	— 2.7	Basin	102	11	3 stations	27 3 dates	1.69	+0.51	Pine Bluff	5.21	Dubois	0.14

*Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut. †46 stations, with an average elevation of 649 feet. ‡127 stations.

apple crop was short and quality poor. The hay crop was good.—*Roscoe Numn.*

Texas.—Generally warm, but cool at end of first and beginning of second decade. Too much rain northeast and east and too little south. In the northwest rainfall was favorable for crops. Cotton improved, except in northeast and east, where rains were injurious. Boll weevil and boll worm increased early in month, but diminished later. Picking was quite general in southwest by end of month. Corn improved during month. Rice and sugar cane did well. Grain was damaged by rain. Grass and stock did well.—*M. E. Blystone.*

Utah.—Hot and dry first portion of month; general thunderstorms and cooler second decade; light showers and much warmer toward close of month. Where irrigated, crops did remarkably well; arid farms in some sections were suffering. Small grain matured rapidly and was being extensively harvested, with average yields. Haying general, with good crops reported. Corn improved and tasseling. Abundance of superior potatoes being dug. Garden truck and fruit were maturing fast. Sugar beets promised well. Ranges drying, but stock doing well. Water becoming scarce.—*R. J. Hyatt.*

Virginia.—Harvest of winter wheat and oats was nearly completed and that of spring oats well advanced during the month. Thrashing was much delayed by persistent rains which, with warm and humid conditions, caused considerable injury to the grain. Corn made excellent progress. Tobacco did not do well until the latter part of the last decade, when some improvement occurred. Gardens and minor crops were generally very good. Fruit, especially apples, continued to fall and was generally scarce and inferior.—*Edward A. Evans.*

Washington.—The weather was in general, although not altogether, favorable to the growth and development of crops. Scarcity of rain dried up pastures and meadows and affected oats on uplands. Dry and hot winds at the beginning of the third decade caused considerable burning or shriveling of late spring wheat and oats. Winter wheat and early

spring grain were not injured. Corn, potatoes, and hops made satisfactory progress.—*G. N. Salisbury.*

West Virginia.—Hot, showery weather prevailed during the first three weeks, and was very beneficial for crop growth. The cutting of hay and oats and the stacking of wheat were considerably delayed, but the fourth week was very favorable for this work. Corn made rapid growth and was very promising. Pastures and stock were in fine condition. Millet, buckwheat, cowpeas, cabbages, and gardens were doing well.—*E. C. Vose.*

Wisconsin.—The month was characterized by a deficiency of rainfall, moderate temperature, a good supply of sunshine, and severe local hailstorms. Tobacco was damaged considerably by hail and grains were generally lodged by high winds. Corn made rapid headway. Hay was well secured and was an unusually large crop, nothwithstanding damage by adverse weather conditions earlier in the season. Spring grains made good progress. Pastures and meadows were in excellent condition. Fruits and berries were a heavy yield. Sugar beets continued in fine condition. The apple crop was not in satisfactory condition.—*J. W. Schaeffer.*

Wyoming.—The weather was favorable for the growth of grain and gardens, which made favorable progress; at the close of the month gardens were in excellent condition, and a good crop of grain was beginning to ripen in the earlier sections. A good crop of native hay was being secured, but showers interfered with its harvest. Ranges continued excellent and cured very slowly, in some sections remaining green to the close of the month. All stock was in excellent condition.—*W. S. Palmer.*

SPECIAL ARTICLES.

STUDIES ON THE DIURNAL PERIODS IN THE LOWER STRATA OF THE ATMOSPHERE.

By Prof. FRANK H. BIGELOW.

V.—THE VARIABLE ACTION OF THE SUN AND ITS EFFECT UPON TERRESTRIAL WEATHER CONDITIONS.

APPLICATIONS TO THE PROBLEMS OF THE WEATHER.

The foregoing correlation of the connections between the phenomena of temperature, pressure, vapor tension, atmospheric electricity, ionization, and magnetic vectors seems to give a natural unity to these data which have been detached from one another in the previous scientific researches. The entire train of causes and effects is arranged by it in a satisfactory sequence, so that we are for the first time in a position to summarize the masses of evidence lying before us. It will be now possible, having a clear working hypothesis before us, to indicate the proper manner of continuing the investigations with every prospect of reaching a successful practical result. I propose in the remaining papers of this series to lay down a working program for American meteorologists to use, including in that term those astrophysicists who are interested in the sources of our radiant energy, as well as the climatologist and the forecaster who are concerned with the effects of radiation upon climatic and weather variations. The first paper will contain a popular statement of the general conditions; the second, a more technical account of the theoretical aspects of the problem of cosmical meteorology; and the third, a description of the organization of the Mount Weather Research Observatory which is designed to mediate between the theoretical and the practical sides of the subject.

THE SUN A VARIABLE STAR.

In order to bring out the underlying reason for believing that variable solar action is responsible, at least indirectly, for changes in the terrestrial weather from year to year, it is necessary to show in what way the sun is itself unequal in its internal movements. The sun is an immense solid-liquid mass, 866,000 miles in diameter, surrounded by a gaseous envelope which gradually changes to rarefied matter similar to that seen in vacuum tubes. Recent computations indicate that at the center of the sun there is a nucleus which instead of being gaseous is nearly as solid as the interior of the earth, with a temperature of about 10,000° centigrade; the average density of the whole sun is 1.43 times that of water, and this is located at half the distance from the center to the surface; the surface density is not far from 0.37 that of water, and its temperature, according to my calculation, ranges between 7000° and 6000° centigrade; at the surface there is a sudden transition from liquids to gases, which occurs as an explosion, caused by the uprush of liquids from the interior. The solar mass in such a physical state while rotating on its axis sets up a peculiar circulation, in consequence of which at the surface a huge wave is formed like a tide that advances most rapidly in the equatorial belt.

The body of the sun is divided up into layers of different temperatures, like a set of dice boxes inside one another, the longest axis extends through the sun from pole to pole, and these slide by one another at different velocities. This produces a stronger discharge of warm material in the polar regions than near the equator, so that on the sun the heat is greatest at the poles, reversing the conditions with which we are familiar in the earth's atmosphere.

The evidence for these facts is found in a study of the (1) sun spots, which occur in belts within 35° of the equator; (2) the faculæ or fleecy cloud-like forms found on all parts of the sun's surface, but most abundantly around the spots; (3) the prominences or gaseous flames projected in all latitudes above the disk; and (4) the coronas, which extend to great distances from the surface and somewhat resemble auroras in their nature.

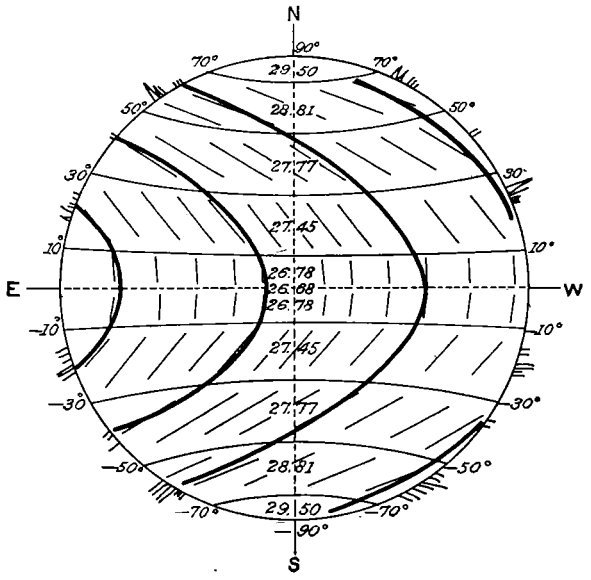

FIG. 64.

The visible surface is divided for convenience into successive zones beginning at the equator as shown on fig. 64, where the advancing equatorial wave is indicated, the time of rotation being marked in different latitudes with 26.68 days at the equator, increasing to 29.50 days at the poles. The time of the rotation of the internal solid nucleus is not known. There are some arguments for supposing it to be 26.00 days, and others for making it 26.68 days, but the subject has not yet yielded to study. The above periods of rotation are those seen from the earth as it passes around the sun in its orbit of 365 days.

Fig. 65 gives an excellent idea of the visible surface. This is mottled with cloud-like forms resembling the heads of cumulus clouds, and probably they represent the tops of columns of liquid or gaseous matter rising from the interior; there are three minute sun spots to be seen on it, and extensive regions of white calcium flocculi in the sun-spot belts. The spectroheliograph has developed the power to make pictures like this at different levels in the sun's atmosphere, representing sections through it, so that the action of the vapors and gases surrounding a spot can be studied at several elevations, just as we make out the cloud forms at different